U.S. FISH + WILDLIFE SERVICE 9-16-00

IT IS IMPERATIVE TO THE LONG TERM HEALTH OF THE "SOUTHERN" SEA OTTER POPULATION AND THE MARINE ECOSYSTEM THAT THEY INHABIT, THAT THE FOLLOWING IMFORMATION IS FULLY AND COMPREHENSIVLY INCORPARATED INTO THE PENDING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT PERTAINING TO SEA OTTER TRANSLOCATION. NOT ONLY THAT BUT THIS IMFORMATION AND RELATED CONCEPTS NEED TO BE ADDRESSED IN A TOTAL RE-EVALUATION OF THE LONG TERM CARRING CAPACITY OF THE CALIFORNIA COAST IN RESPECT TO SEA OTTER FOOD NEEDS (PREDATION).

FOR THIS DISCUSSION WE WILL DEFINE "NATURAL" AS THE STATE OF OTTERS AND THE ECOSYSTEM THAT THEY EVOLVED WITH AT A POINT BEFORE EUROPEAN INFLUENCE (I.E. PRE-COLUMBIAN).

AT THIS POINT THE OTTER POPULATION WAS AT A LOWER DENSITY THAN CURRENTLY EXISTS ON THE CALIFORNIA CENTRAL COAST! THERE HABITAT WAS CONFINED TO THE NEARSHORE KELP BEDS WHERE THEY WHERE AFORDED SOME PROTECTION FROM THE LARGE AND WELL DISTRIBUTED "PRE-FUR TRADE" WHITE SHARK POPULATION. NATIVE PEOPLES RETARDED POPULATION SIZE THROUGH OTTER HUNTING. AND OF GREAT SIGNIFIGANCE A LARGE "HARVEST REFUGIA" EXISTED AS A NATURAL OTTER FREE ZONE ALONG A FIFTY PLUSS MILE STREACH OF THE SANTA BARBARA COUNTY COAST. THIS OTTER FREE ZONE WAS A RESULT OF THE LARGE AND CONSISTENT OIL SLICK THAT EXISTED IN THIS AREA FOR THOUSANDS OF YEARS. UNTIL MODERN OIL EXTRACTION WITH ITS DIRECT REDUCTION OF SEEP RATES AND COLLECTION OF OIL + GAS FROM MAJOR SEEPS WITH "TENTS" TO GAIN AIR POLLUTION OFFSETS FROM THE A.Q.M.D..

I AM SUBMITING THE FOLLOWING DOCUMENTS TO SUBSTATIATE THE OIL SEEP RELATED STATEMENTS MADE IN THIS COVER LETTER. "THE HISTORY OF OIL + GAS SEEPS IN THE SANTA BARBARA CHANNEL" WESTERN STATES PETROLEUM ASSOCIATION 1997, AND THE DOCUMENTS IN IT'S BIBLIOGRAPHY THAT PERTAIN TO THIS SUBJECT. ALSO "HYDROCARBONS IN THE MARINE ENVIRONMENT; RELATIONSHIPS BETWEEN NATURAL HYDROCARBON SEEPAGE AND OIL PRODUCTION." DR BRUCE P. LUYENYK, DIRECTOR, INSTITUTE FOR CRUSTAL STUDIES, DEPT. OF GEOLOGICAL SCIENCES, U.C.S.B. CA. 93106, ET ALL.

IN THIS PRE-EXTRACTION ENVIROMENT TWENTY TWO MAJOR OIL SEEPS EXISTED FROM POINT CONCEPTION TO RINCON POINT IN SANTA BARBARA COUNTY NEARSHORE COSTAL WATERS. THE COAL OIL POINT AREA ALONE AVERAGED UPWARDS OF 150 BARRELS A DAY OF SEEPAGE WITH A YEARLY FLOW OF 55,000 BARRELS OF OIL! (PAGE 8 W.S.P.A.) DURING THE LAST 100 YEARS (EXCELERATING DURING OUR LIFETIME) THESE FLOWS AND THE CORRESPONDING SLICK HAS BEEN VIRTUALY ELIMINATED! (LUYENDYK FIGURE 3 ETC.)

THE EFFECT OF THESE OIL SLICKS AS BOTH A DETURENT TO HABITATION AND A DIRECT MORTALITY FACTOR ON SEA OTTERS IS WELL ESTABLISHED. THE RESULT BEING THAT THE SANTA BARBARA NEARSHORE COASTLINE WAS A NATURAL OTTER FREE ZONE!

AS HAS BEEN SHOWN BY EGG AND LARVA STUDIES THE REPRODUCTIVE POTENTIAL OF THIS "OTTER (FREE) HARVEST REFUGIA" IS CRITICAL TO THE PRODUCTIVITY OF THE OTTER'S FOOD SOURCE SPECIES IN THE SOUTHERN CALIFORNIA BITE AND CENTRAL COAST, (FOOD SOURCE SPECIES = URCHINS, ABALONE, CRAB, LOBSTER, CLAMS ETC.).

THE PENDING SUPPLEMENTAL E. I. S. AND <u>ALL</u> OTHER SEA OTTER RELATED DOCUMENTS AND POPULATION MODELS NEED TO BE RE-EVALUATED IN LIGHT OF THESE FACTS.

CURRENTLY THE 2,000 - 3,000 SEA OTTERS INHABITING THE CENTRAL COAST ARE AT A POPULATION LEAVEL THAT IS <u>UNATURLY HIGH</u> FOR THIS AREA IN PRE COLUMBIAN TERMS. NOW THAT THE WHOLE OF SOUTHERN CALIFORNIA AND MUCH OF NORTHERN CALIFORNIA IS ACTING AS HARVEST REFUGIA FROM OTTER PREDATION, THE EFFECT IS TO RE-POPULATE AND RE-SEED THE OTTER ZONE FROM THE OTTER FREE ZONE THERBY GREATLY INCREASING THE CARRYING CAPACITY OF THE CURRENT OTTER ZONE.

THE LACK OF POST FUR TRADE WHITE SHARK POPULATIONS HAS OPENED LARGE AREAS OF FEEDING HABITATE TO SEA OTTERS ON THE CENTRAL COAST (IE THE 90'-180' ZONE) THIS AREA HISTORICLY WAS NOT AND IN THE FUCHARE WILL NOT BE AVAILABLE TO SEA OTTERS, AS THE WHITE SHARK POPULATION REBUILDS ON THE CALIFORNIA COAST. THIS WILL REDUCE THE CARRYING CAPACITY OF THE CENTRAL + SOUTHERN CALIFORNIA COAST BELOW CURRENT LEVELS.

THE FOLLOWING SENARIO IS THE MOST LIKELY RESULT OF THE END OF THE TRANSLOCATION PROJECT AND THE INTRODUCTION OF OTTERS TO SOUTHERN CALIFORNIA IN THE UNNATURALLY HIGH DENSITY MODE THEY A CURRENTLY IN, THIS WITHOUT THE PROTECTIVE EFFECTS OF A OIL SLICK DRIVEN OTTER FREE ZONE.

THE OTTER POPULATION'S HIGH DENSITY MALE DOMINATED FRONT MOVES SOUTH ALONG THE COAST AND CHANNEL ISLANDS. THIS HISTORICLY UNATURAL HIGH DENSITY PREDATION PUSHES OTTER PREY SPECIES FAR BELOW THERE CURRENT OR PRE-COLUMBIAN POPULATION LEVELS. WITHOUT THERE RE-POPULATING EFFECTS ON THE CENTRAL COAST THE CARRYING CAPACITY OF THE [redacted] CURRENT OTTER ZONE FALLS SIGNIFIGANTLY. THIS AREA BEING MORE IMPORTANT TO OTTER POPULATION SUCCESS DUE TO THE HIGHER NUMBERS OF FEMALES AND YOUNG THAT DEPEND ON IT. WITHOUT THE OIL SLICK RELATED OTTER FREE ZONE IN THE SOUTHERN CALIFORNIA BITE THE PRODUCTIVITY AND RELATED CARRYING CAPACITY OF THIS AREA PLUMITS WITH A GREATLY DIMINISHED CAPACITY TO RECOVER. AS THE EXPANDING OTTERS UTILIZE THE LAST OF THE POST FUR TRADE "VIRGIN" FOOD RESOURCES, THE HEALTH OF THE ECOSYSTEM WILL BE NEGATIVLY IMPACTED TO THE EXTENT THAT THE LONG TERM OTTER CARRING CAPACITY STATEWIDE WILL BE FAR BELOW CURRENT OR PRE-COLUMBIAN LEVELS. THE OPTIMUM SUSTAINABLE POPULATION WILL BE LESS THAN NOW EXISTS UNDER CURRENT OTTER POPULATION DISTRIBUTION!!

THE CUMULATIVE EFFECT OF OTTER POPULATION EXPANSION WITHOUT NATURAL OTTER FREE ZONES AND WHITE SHARK PREDATION THAT THE OTTER POPULATED ECOSYSTEM EVOLVED WITH IS A MUCH SMALLER OTTER POPULATION THAN CURRENTLY EXISTS!

IT IS OF NOTE THAT THE TOTAL POPULATION OF "SOUTHERN" SEA OTTERS IS DIRIVED FROM A CORE POPULATION OF LESS THAN FIFTY ANIMALS THAT IN ^ LESS THAN 100 YEARS HAS REPOPULATED TO 2,000-3,500 +.

THERE CAN BE LITTLE CREDABLE ARGUMENT THAT THE 20± ANIMALS AT SAN NICHOLAS ISLAND IS A SUCCESS IN TERMS OF POST OIL SPILL RE-POPULATION. NO OIL SPILL WILL KILL EVERY OTTER ON THE CENTRAL COAST. THE SURVIVORS COMBINED WITH THE SAN NICHOLAS POPULATION WOULD PROVIDE WHAT LITTLE GENETIC DIVERSITY THAT CURRENTLY EXISTS IN THE "SOUTHERN" OTTER POPULATION TO INSURE A RE-POPULATION.

SUGGESTIONS:

ONE: DECLARE THE TRANSLOCATION A SUCCES, ISSUE AN INCIDENTAL TAKE STATEMENT UNDER THE E.S.A. TO CONDUCT THE USE OF HARASMENT TECHNIQUES ON A 24-7-365 BASIS TO MAINTAIN THE OTTER FREE ZONE SOUTH OF POINT CONCEPTION.

TWO: SHOULD THE TRANSLOCATION BE DEAMED A FAILURE DUE TO THE CURRENT POLITICALY INFLUCIED PROCESS OR JUST FLAWED LEGISLATION, AND OTTER EXPANSION INTO SOUTHERN CALIFORNIA BE ALLOWED IN AN UN-RESTRICTED UN-NATURAL MANNER. I WOULD VIGORISLY ADVOCATE THE RE ESTABLISHMENT OF THE SANTA BARBARA COUNTY NEARSHORE NATURAL OIL SLICKS, THROUGH THE PLACEMENT OF DIFFUSER PIPES AND THE SUPPLIMENTAL RELEASE OF OIL TO HISTORIC PRE-COLUMBIAN (PRE-EXTRACTION) LEVELS IN THE HISTORIC SEEP AREAS. THIS COMBINED WITH THE REMOVAL OF ALL SEAFLOOR OIL SEEP CONTAINMENT TENTS AND DEVISES.

IF THE PRECEDING ACTIONS ARE BLOCKED BY THE CONTRIBUTION BASED ORGANIZATIONS OF THE ENVIRONMENTAL COMMUNITY THAT MAY IGNORE HOLISTIC ECOLOGICAL ANALYISIS WHEN IT RUNS CONTRARY TO THERE SIMPISTIC PARTY LINE, EVEN WHEN TO DO SO IS CONTRARY TO THE BEST LONG TERM INTEREST OF SEA OTTERS.

I WILL MAKE THIS LAST SUGGESTION:

THREE: THOSE IMPACTED COMMERCIAL FISHERMEN THAT WILL LOSE THE SUSTAINABLE FISHERIES THEY HAVE NURTURED AND DEPENDED ON FOR THERE LIVLYHOOD. (FISHERIES LOST TO SEA OTTER PREDATION IN AN AREA THAT WAS AND WOULD BE OTTER FREE IF NOT FOR THE ACTIONS OF THE OIL INDUSTRY, GOVERNMENT AND "OTTER ADVOCACY" "ENVIROMENTAL" GROUPS.) SHOULD BE FINACIALY COMPENSATED FOR THERE LOST CATCHES. SUCH MITAGATION IS THE LAST CHANCE FOR JUSTICE IN A SYSTEM WHERE RESOURCE MANAGERS AND THE SCIENTIFIC COMMUNITY WHERE NEGLIGENT IN DOING THE BASIC RESERCH NESSACARY TO MAKE INFORMED DECISIONS IN REGARDS TO OTTER MANAGMENT.

THE CURRENT POLICY SHIFT ALTHOUGH POSSIBLY WELL MEANING IS TOTALY COUNTER PRODUCTIVE TO LONG TERM OTTER POPULATION HEALTH!

Sincerely,

Philip Begnal

COMMERCIAL FISHERMAN REPRESENTATIVE - SANTA BARBARA COUNTY FISH AND GAME COMMISION

The History of Oil and Gas Seeps in the Santa Barbara Channel

WSPA
Western States Petroleum Association

The Santa Barbara Channel Holds a Rich Bounty of Natural Resources

The Channel Islands stand at what sometimes appears to be an arm's length away. Their sharp cliffs, rocky coves, and curving grasslands form a rich ecosystem. The Islands and the Channel are home to an abundance of marine animal and plant life. More than 30 species of whales alone migrate through the Santa Barbara Channel each year.

On the mainland shores, tide pools are crowded with crustaceans, hydrocorals, and sea anemones, which are nurtured by the Channel's gentle tides.

Hints of hidden treasures beneath the Channel's surface have been washing ashore for centuries. However, one particular gift from the sea no longer enjoys the popularity it had centuries ago.

To the dismay of local beach-goers today, sticky globules of tar lap up onto our coastline. This tar is an annoyance to many of us and is often perceived to be a man-made pollutant.

In fact, tar is a natural by-product of huge seeps that have been spewing oil and gas from beneath the Santa Barbara Channel for centuries.

Like carbonated soda bubbles, gas bubbles float to the surface of the ocean, where they burst into the atmosphere. Oil drifts to the Channel's surface forming slicks, and then coagulates into tar and drifts onto our beaches.

Despite its current lack of popularity, tar is an important part of our local history. Archaeological evidence demonstrating the population's use of oil and tar in the Santa Barbara area can be traced as far back as 6,000 years ago.

B.C.5,000

Archaeological evidence shows humans have inhabited the region for more than 6,000 years. Oil and tar were used to enhance their way of life.

The Islands are Born

To appreciate the magnificent workings of nature, one must transition from an archaeological time frame to time on a geological scale.

Approximately one million years ago, the Channel Islands were linked to the mainland, forming a large land mass that extended to the Santa Monica mountain range. Changes in sea level eventually led to the isolation of the Channel Islands from the mainland.

Meanwhile, the earth's structure shifted and changed under extraordinary geological pressures to create enormous accumulations of hydrocarbons. Earthquakes, which cause cracking in the brittle ocean floor, together with the subterranean pressure, led to the natural seepage of oil and gas.

Eventually, attention was drawn to the Channel area as a place for offshore oil and gas exploration because of the abundance of natural seepage.

Tar and Feathers

Like the famous La Brea tar pits in Los Angeles, the Santa Barbara area has a rich paleontological history.

In the winter of 1926 there was a major fossil discovery in the Carpinteria beach area. Some of the bones revealed were identified as the Imperial Mammoth, the Giant Ground Sloth, and what is believed to be an early ancestor of the California Condor.

Paleontologists believe that asphalt probably seeped to the surface through fissures in the earth during the warm summer weather. As leaves and dust often concealed the resulting shallow tar puddles, animals became trapped by the asphalt and, in turn, lured other scavengers to a similar fate. During the winter, cool temperatures solidified the asphalt and rain-water-choked streams deposited a layer of sediment over the exposed bones, preserving them for thousands of years.

It's believed that these animals lived between 11,000 and 40,000 years ago in the coastal areas of the Santa Barbara Channel.

A.D. 500

The local invention of the plank canoe, or "tomol," 1,500 years ago was the most pivotal development for the Channel Native Americans. They boiled tar to caulk their new mode of transportation.

Channel Natives Invent the Plank Canoe

Archaeological discoveries indicate that the Santa Barbara area is among the oldest sites of human habitation in America. Radiocarbon dating shows evidence that human inhabitants were in Goleta more than 7,000 years ago.

These aboriginal ancestors of the Channel Native Americans inhabited the Goleta Slough region. The Channel Native Americans thrived in the benign climate for thousands of years. Rich in natural resources, the Santa Barbara Channel offered them a bountiful existence.

They made use of the natural oil seeps to enhance their standard of living. Woven water bottles were caulked with asphaltum or tar to make them waterproof (the tar was applied with hot pebbles). Indian women wadded up tar and used it as weights to hold down the bottoms of their grass skirts.

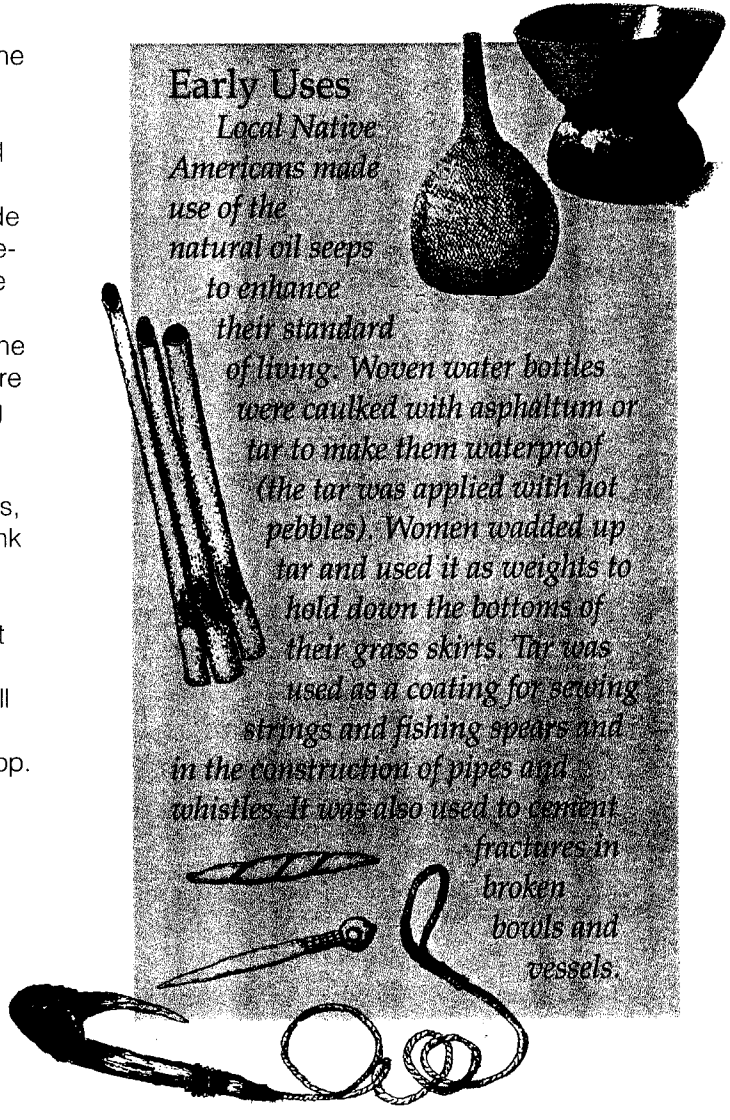
Tar was used as a coating for sewing strings and fishing spears and in the construction of pipes and whistles. It was also used to cement fractures in broken bowls and vessels. Tar was an important part of everyday life.

But the most pivotal development for the Channel Native Americans came with the invention of the plank canoe or tomol. Experts say the local invention of the tomol occurred about 1,500 years ago.

These canoes were constructed outside of the natural redwood region where canoe-sized logs were much more plentiful. Since the Channel Native Americans had to rely upon redwood drifting down the coast or the poor-quality pine available locally, they were forced to use their ingenuity when building their canoes.

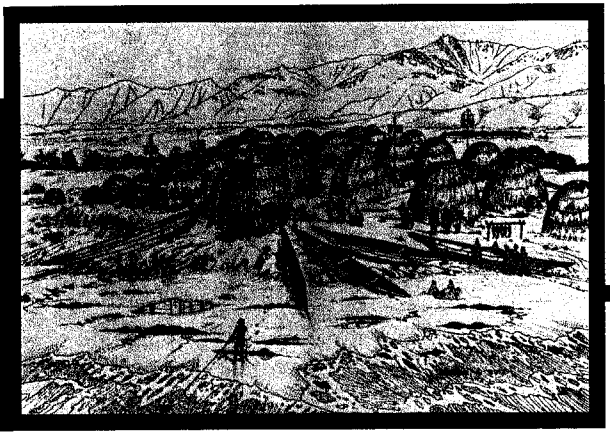
Without the benefit of huge pieces of wood needed to make dugout style canoes, they turned to boiling tar to caulk their plank canoes.

Caulking was done by removing the outside skin of a dry tule stalk and taking out the heart of the plant. They would force the stalk into the cracks on the outside of the hull of the canoe and coat it later with boiled tar, red ochre, and a pine pitch mixture called yop.



Early Uses

Local Native Americans made use of the natural oil seeps to enhance their standard of living. Woven water bottles were caulked with asphaltum or tar to make them waterproof (the tar was applied with hot pebbles). Women wadded up tar and used it as weights to hold down the bottoms of their grass skirts. Tar was used as a coating for sewing strings and fishing spears and in the construction of pipes and whistles. It was also used to cement fractures in broken bowls and vessels.



The plank canoe allowed the Native Americans to fish over a wider area of the sea and to trade more extensively with other tribes. Woqo, a hard tar that Native Americans dug or mined at Goleta Point and More Mesa, was used to caulk canoes and also prepared as a product for trade.

A.D. 1,000

Tar Improves the Prehistoric Way of Life

The Channel Native Americans made use of two kinds of tar: malak and woqo. Malak was the soft tar which was thrown out by the sea, much of which was found on the beaches. Because malak is biodegradable, it was not used on canoes as is commonly believed, nor was it used for the application of ornaments.

It was woqo, the harder tar, that the Native Americans dug or mined at Goleta Point and More Mesa (west of Santa Barbara) to make the yop for caulking. The Native Americans refined the woqo by boiling it, thereby enhancing its adhesive and waterproofing properties.

Woqo was particularly abundant around More Mesa. In fact, the Native Americans' name for the area was Woqwoqo, which means "much tar."

The plank canoe allowed the Native Americans to fish over a wider area of the sea and to trade more extensively with other tribes. Woqo was also prepared as a product for trade.

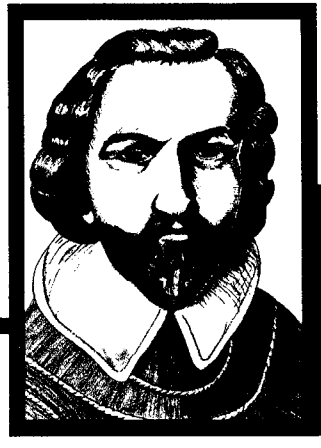
With their riches and sophistication, the population of coastal Native Americans had grown to approximately 15,000 when the Spanish explorers came to the area in the 16th century.

Early Explorers Discover Seeps... and Santa Barbara

Early sailing ships from abroad were often greeted by the sight of miles of tar and oil floating in the Santa Barbara Channel near Goleta, accompanied by the sulfur-like smell of the raw oil.

Most historians agree that the first foreign explorer to lay eyes on the Goleta area did so from the crow's nest of Juan Rodriguez Cabrillo's flagship on Monday, October 16, 1542. Cabrillo recorded that the Native Americans along the Santa Barbara Channel used asphaltum to caulk their canoes. He followed the Native Americans' example, using the substance to waterproof two of his own ships.

In 1792, Captain Cook's famous navigator, George Vancouver, reported that the ocean near Goleta was covered with an oily surface in all directions. According to Vancouver, the oil was so thick that the entire sea took on an iridescent hue. Many other explorers reported similar sightings.



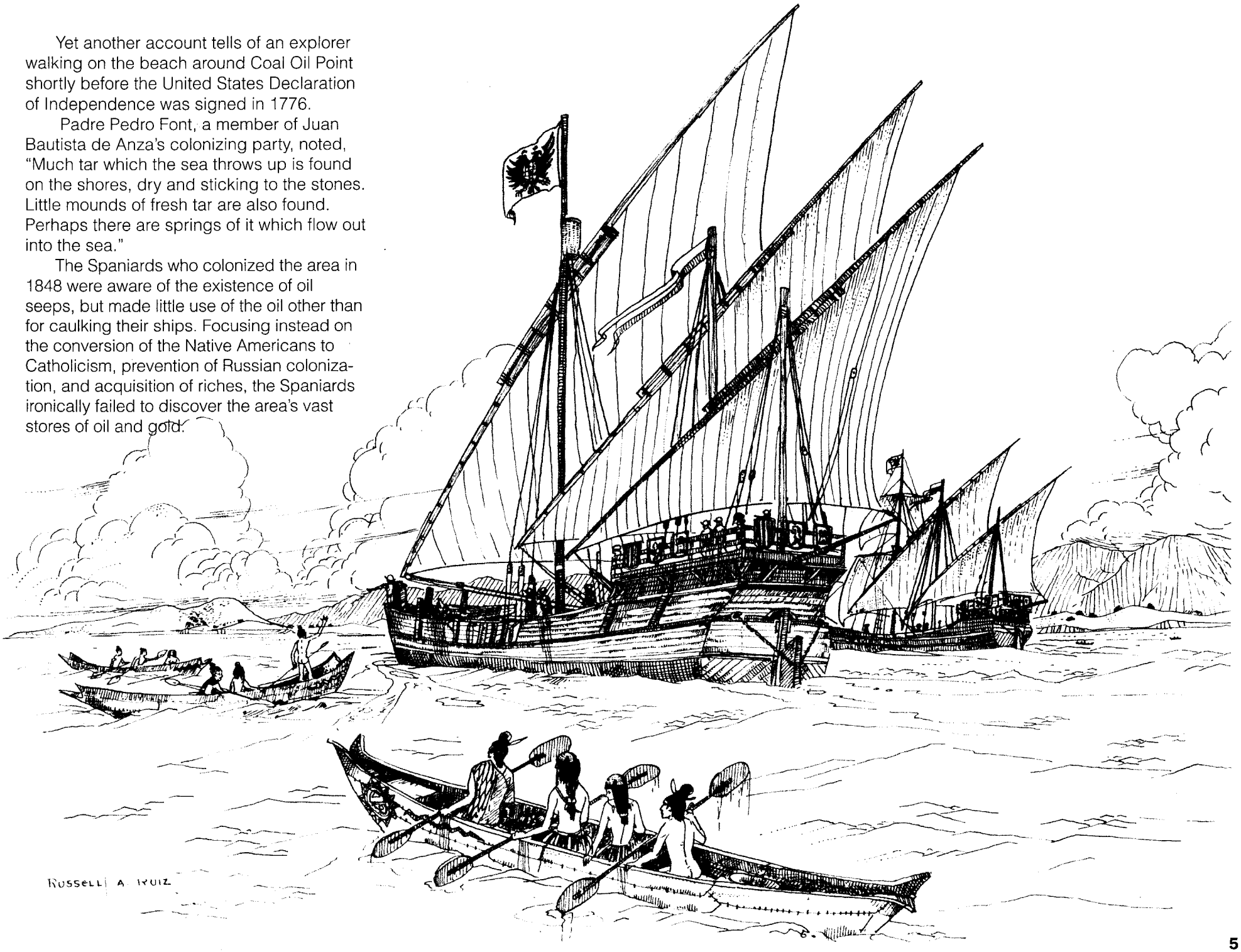
A.D.1542

Juan Rodriguez Cabrillo, the first of many explorers to record the uses of asphaltum by Native Americans, used the substance to waterproof two of his own ships.

Yet another account tells of an explorer walking on the beach around Coal Oil Point shortly before the United States Declaration of Independence was signed in 1776.

Padre Pedro Font, a member of Juan Bautista de Anza's colonizing party, noted, "Much tar which the sea throws up is found on the shores, dry and sticking to the stones. Little mounds of fresh tar are also found. Perhaps there are springs of it which flow out into the sea."

The Spaniards who colonized the area in 1848 were aware of the existence of oil seeps, but made little use of the oil other than for caulking their ships. Focusing instead on the conversion of the Native Americans to Catholicism, prevention of Russian colonization, and acquisition of riches, the Spaniards ironically failed to discover the area's vast stores of oil and gold.



Black Gold

Awareness of the region's potential petroleum reserves continued to grow. In 1852, pioneer Cris Danielson, settled near Coalinga. His accounts reveal that he and his family used to pack a picnic lunch and drive the family wagon to one of the nearby oil seeps where they collected buckets of oil and used it as axle grease.

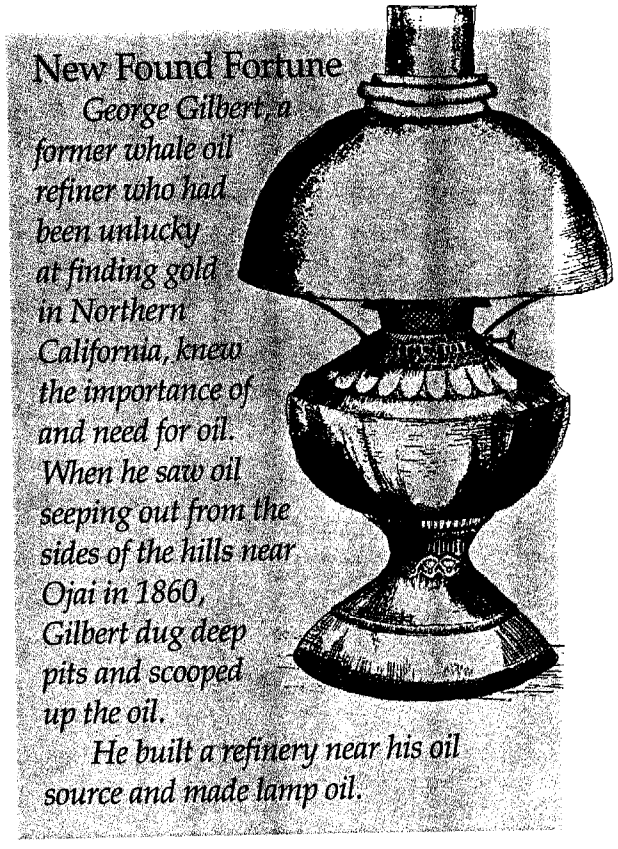
That same year, Colonel James Williamson reported a rich vein of tar on Rancho Ojai, a few miles northeast of Ventura. And, in 1853, geologist William P. Blake reported "bituminous effusions" about 300 miles south of San Francisco. The same deposit was recorded by Thomas Antisell in 1855.

As early as the 1850s, California settlers began to tap this plentiful natural resource. Still three years before the country's first oil well was drilled in Pennsylvania by Colonel Edwin L. Drake in 1859, emerging markets for oil attracted more and more entrepreneurs who originally came to California in search of gold.

George Gilbert, a former whale oil refiner who had been unlucky at finding gold in Northern California, knew the importance of and need for oil. When he saw oil seeping out from the sides of the hills near Ojai in 1860, Gilbert dug deep pits and scooped up the oil. He built a refinery near his oil source and produced lamp oil.

With the invention of the incandescent light bulb by Thomas Edison still 15 years away, kerosene—cleaner and more efficient than whale oil—became a major source of fuel for lighting. As such, it also became the most valuable product made from petroleum.

So much natural oil flowed onto the surface near Gilbert's refinery in Ojai that nearby streams and rivers were polluted with it. When Professor Benjamin Silliman of Yale University visited Gilbert's oil refinery in 1864, he wrote, "The oil is struggling to the surface at every available point and is running down the rivers for miles."



New Found Fortune

George Gilbert, a former whale oil refiner who had been unlucky at finding gold in Northern California, knew the importance of and need for oil. When he saw oil seeping out from the sides of the hills near Ojai in 1860, Gilbert dug deep pits and scooped up the oil.

He built a refinery near his oil source and made lamp oil.

A.D.1848

On January 24, 1848, California's history was drastically altered when James W. Marshall discovered gold at Sutter's Mill, transforming California from a rural agricultural region to a bustling trading area.

The Birth of a New Industry

Impressed with Silliman's description of the natural seeps, Colonel Thomas A. Scott, vice-president of the Pennsylvania Railroad, formed a syndicate of investors. With his friend and business associate, Thomas Bard, Scott started drilling for oil near Gilbert's discovery in 1866.

By 1876, the growing Southern Pacific Railroad made the transportation of oil feasible at low cost, which would facilitate the eventual onset of the California wildcat boom.

Although oil could be seen seeping out of the land near the sea at Carpinteria and other points along the Channel, early pioneers preferred to try their luck near the inland seeps.

Summerland played a brief, but important, part in the early days of the oil industry. In 1887, while a water well was being drilled at Ortega Hill near Summerland, oil was discovered. But, due to the accidental nature of this and some other first oil discoveries, they were not taken seriously.

Yet there was another natural resource awaiting discovery that would prove equally significant.

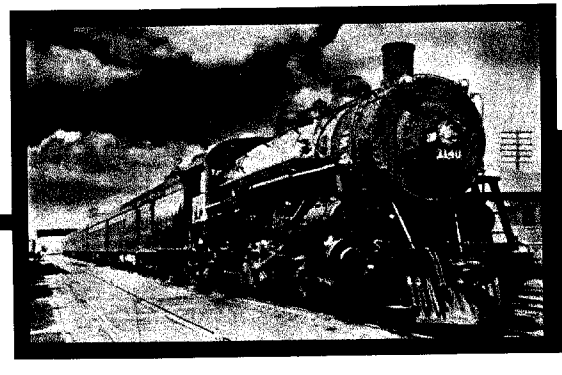
Oil and Gas Discoveries Help Save Coastal Oaks

In 1890, while drilling for hot sulfur water, a resident detected a strong smell of gas. It wasn't long before an editorial in the Santa Barbara Daily Press reported that the prospects were bright for this "cheap fuel."

Local press viewed the availability of gas for fuel as the savior of the live oaks that were being cut down along the coastal mountains for use as firewood. Wood was the main source of fuel for cooking in Santa Barbara and Ventura Counties at the time, and the discovery of gas and oil prevented further destruction of the few remaining wooded areas.

As the gas industry emerged in the 1880s, so did the Santa Barbara area's reputation as a health resort. In fact, until the turn of the century the area enjoyed as much prestige as some of the high-profile European spas and springs.

In addition to the numerous mineral, hot, and cold springs which were exploited all around Santa Barbara, it was claimed that the prevailing southwest winds blowing over a large offshore oil and gas seep purified the atmosphere and was a decided benefit to almost all chronic illnesses.

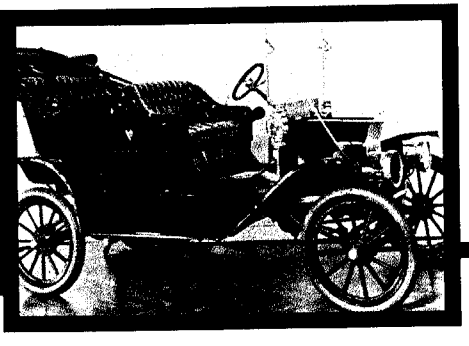


Southern Pacific Railroad comes to Santa Barbara. The growing railroad made the transportation of oil feasible at low cost.

A.D.1876

A.D.1903

In 1903, Henry Ford delivered his first Model T to dealers. By 1911, there were 600,000 cars on the road. This was the first year the oil industry manufactured more gasoline than kerosene.



A Forest in the Channel

In 1886, one observer wrote, "At two o'clock, we passed Goleta and saw petroleum spreading over the sea, rising from submarine spirits... I had often heard of this locality and the oil springs, but I did not realize the extent of the surface covered or the significance from an economic standpoint."

As oil and gas are often found in conjunction with each other, it wasn't surprising that oil was again found a few years later in Summerland. In 1896, the first offshore oil production in the U.S. started along the coastline of Summerland. The prosperity of the Summerland oil fields came and went and, by 1920, most of the 400-plus oil wells were depleted.

In spite of the ventures and early successes at Summerland, most early-day California oil explorers falsely believed that the coast of the Santa Barbara Channel held little crude oil.

This changed dramatically in 1928 when the Barnsdall and Rio Grande oil companies discovered the Ellwood Oil Field about ten miles west of Santa Barbara. The oil was produced from piers that were built on Ellwood Beach. Oil tanks that were constructed in 1929 to store the Ellwood oil are still in use west of the University of California at Santa Barbara (UCSB) campus.

The Largest Seep in the Western Hemisphere

While the Ellwood Oil Field was discovered in the late 1920s, it wasn't until the mid-1940s that scientists began studying the intense offshore oil and gas seepage zone near Goleta. Subsequent studies were also conducted in the 1950s and 1970s. Spanning an area three miles long and one mile wide, the seep exhibits all the characteristics usually associated with a major underground oil deposit.

Numerous oil and gas seeps are located along the entire coast of Santa Barbara County and Northern Ventura County. The largest and most studied concentration of seeps are collectively referred to as the Coal Oil Point seeps. There are actually two large seepage areas; one close to shore and another located about two miles offshore.

According to modern studies released by the California State Lands Commission in 1978, there have been more than 1,200 natural seeps charted in the entire Santa Barbara Channel. Half of these occur within three miles of Coal Oil Point. The only area with more prolific natural seepage in the world is the Caspian Sea in the Republic of Azerbaijan (in the former Soviet Union).

It's estimated that oil seepage for the entire Coal Oil Point area averages 130–150 barrels of oil each day. At a seepage rate of 150 barrels of oil per day, 55,000 barrels of oil seep into the ocean every year. For comparison, the amount of oil released each year is enough to fuel all the cars on the road in Santa Barbara County for seven and one-half years.

As a result of weather and ocean conditions, the greatest amount of tar appears on Santa Barbara beaches during the summer months. Surprisingly, scientific evidence indicates that the Coal Oil Point seeps are also responsible for half of the tar that washes up on beaches in the Los Angeles area.

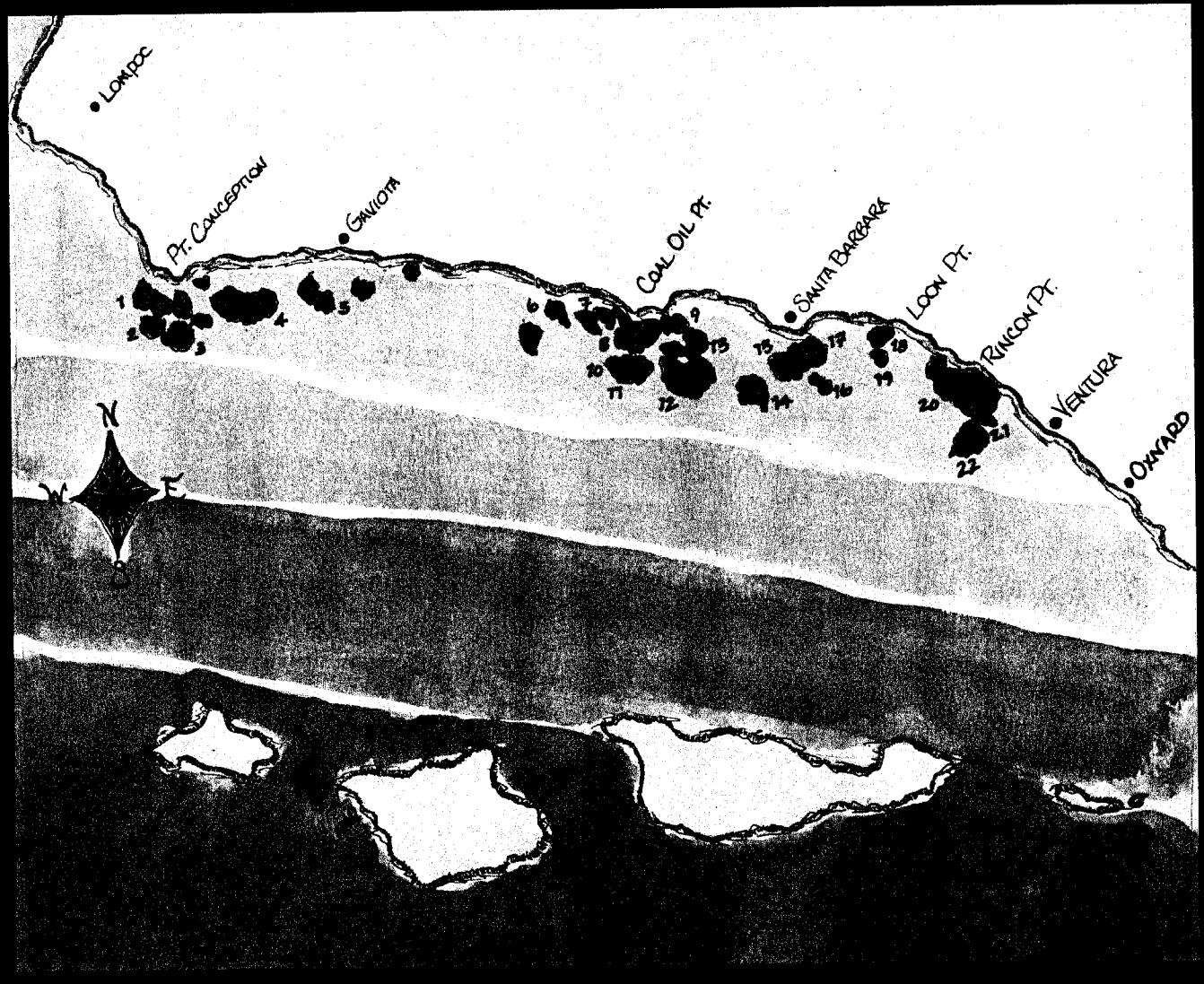
The Ellwood Oil Field is discovered ten miles west of Santa Barbara. Oil tanks constructed in 1929 to store the Ellwood oil are still in use today west of the University of California, Santa Barbara campus.

A.D.1928

A.D.1942

On February 24, a Japanese submarine shells the Ellwood oil piers. This was the only attack on the U.S. mainland during World War II.

Seep Locations



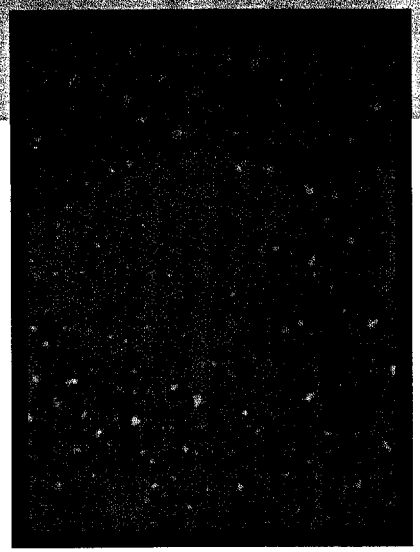
Numerous oil and gas seeps are located along the entire coast of Santa Barbara County and Northern Ventura County. The largest and most studied concentration of seeps are collectively referred to as the Coal Oil Point seeps.

Seep Names:

1 *Conception*
2 *Bixby*
3 *Government Point*
4 *Cojo*
5 *Gaviota*
6 *Capitan*
7 *Ellwood*
8 *West Coal Oil*
9 *Coal Oil*
10 *West Goleta*
11 *South Ellwood*
12 *West Rincon*
13 *East Goleta*
14 *Atascadero*
15 *La Mesa*
16 *Castillo*
17 *Santa Barbara*
18 *Summerland*
19 *Loon Point*
20 *Carpinteria*
21 *East Carpinteria*
22 *Rincon*

Aptly Named

Coal Oil Point, located one mile west of the University of California, Santa Barbara campus, got its name from the nearly 250 known active natural oil and gas seeps on the ocean floor.



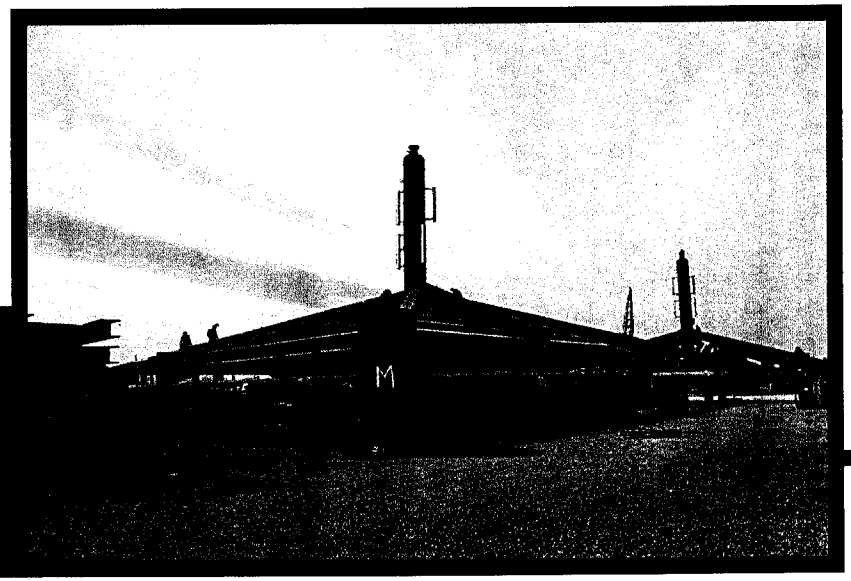
Steel Pyramids Capture Escaping Gas

One of the largest and most active gas seeps is located off Coal Oil Point. In 1982, the innovative Seep Containment Project was developed by ARCO, Mobil, and several other partners to capture the free-flowing gas.

Two 50-foot high steel pyramids were positioned on the ocean floor over this seep. These giant tent structures are used to capture escaping oil and gas from the ocean bottom. Weighing in at a massive 350 tons each and measuring 100 feet on each side, they cover one of the seeps' major vent areas.

From the beginning, the steel pyramids have successfully captured natural gas before it rises to the surface. The gas captured by the seep tents was initially about 25 percent of Santa Barbara County's total hydrocarbon air pollution, an amount roughly equal to the hydrocarbon emissions of more than 35,000 cars driving in and around Santa Barbara each day.

When the steel pyramids are no longer needed, regulatory agencies will decide whether to remove the tents or leave them as artificial reefs.



A.D. 1982

An innovative Seep Containment Project placed two, 50-foot high steel pyramids on the ocean floor to capture oil and gas escaping from the seeps. Each day, the giant tents capture an amount of hydrocarbons roughly equal to the emissions of more than 35,000 cars.

Where Does the Oil Go?

Oil seeping into the Channel and onto the beaches is sometimes blamed on oil companies. Yet, history confirms that natural seeps are the cause of this phenomenon. The seeps produce a persistent oil slick that's usually carried north and west by ocean currents, generally coming ashore between Santa Barbara and Gaviota. As the oil rises to the surface and floats, it coagulates and biodegrades into tar. This is the same tar we find on our beaches along the Santa Barbara coastline.

The most heavily impacted beaches are those between Goleta Point and El Capitan Beach, although wind and currents sometimes take the oil slick northeast onto Santa Barbara city beaches and as far away as Los Angeles beaches. The amount of tar that ends up on the beach also depends on wave activity, since high surf conditions tend to break up the oil slick and prevent it from reaching the beaches.

Seeps and Oil Production in the Santa Barbara Channel

Despite the prolific escape of natural gas in the Santa Barbara Channel, marine geologists say the Channel gas may continue to seep for millions of years. From the Coal Oil Point Seeps alone, oil is expected to continue seeping into Channel waters at an estimated rate of 130–150 barrels a day.

Recent scientific studies suggest that producing the oil and gas from the reservoir will greatly reduce the life of the seeps.

Crude oil seeping into the sea from Coal Oil Point alone is equal to about 55,000 barrels of oil a year. Additionally, five million cubic feet of gas is seeping every day.

Numerous bodies of evidence suggest that gas and oil seeping from the ocean floor in the Coal Oil Point area comes from the reserves within the South Ellwood Offshore Field.

Increased Oil Production May Mean Less Tar on the Beach

A new study of the Coal Oil Point seeps, begun in 1994 with a geophysical survey, suggests that the amount of hydrocarbon seepage in the Santa Barbara Channel has been substantially reduced by offshore oil production.

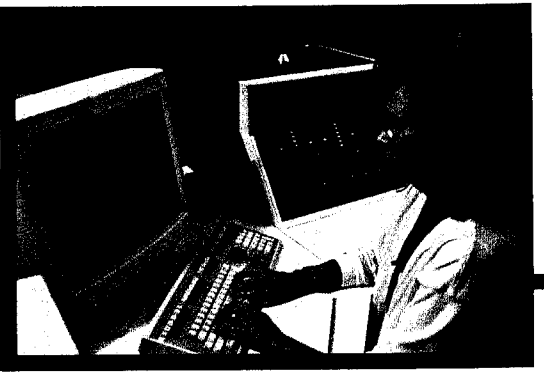
As oil and gas is produced from the underground reservoirs, the pressure that causes oil and gas to seep is decreased.

Additional studies are being conducted by the University of California, Santa Barbara. These studies will further quantify the amount of seep reduction caused by oil production in the Santa Barbara Channel.

The studies are significant because they will determine the amount of oil that can ultimately be removed from local waters and beaches and measure the significant air quality benefits resulting from these seep reductions.

A.D. 1996

Seep studies suggest that producing oil reservoirs reduces natural seepage.



Cleaning Up Our Air

The Santa Barbara County Air Pollution Control District (APCD) has served our county for twenty-five years by regulating local sources of air pollution so residents can breathe clean air.

The APCD Board, which is made up of the Board of Supervisors and representatives from each city in the county, monitors the county's air quality and helps businesses implement new technologies and programs to help clean the air.

Everyone from children to businesses benefits from clean air. Over the years the APCD has helped enhance Santa Barbara County's quality of life by protecting its people and environment from the effects of air pollution.

How Seeps Affect Air Quality

Air pollution caused by the seeps is related to the amount of reactive hydrocarbons contained in seep gas. These hydrocarbons, known as reactive organic compounds, react with sunlight to create smog.

One of the largest sources of hydrocarbon pollution in Santa Barbara County is the uncontained gas seeps above the South Ellwood Offshore Field. Each day, they contribute 29 to 37 tons of reactive organic compounds to the air in Santa Barbara.

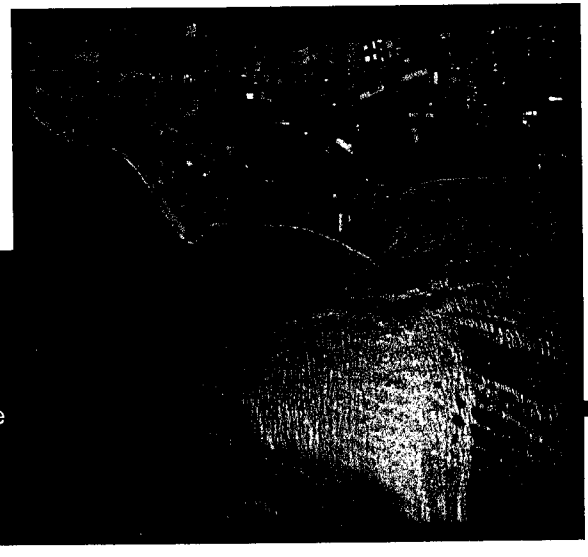
By comparison, all of the motor vehicle trips in Santa Barbara County produce 27 tons of hydrocarbons each day.

With Greater Knowledge, Greater Understanding

The history of seeps in the Santa Barbara Channel and the abundant natural resources they have provided over the centuries give us important insights into our past and future.

We've learned a great deal from our past about recognizing and benefiting from the unique resources we have here in our backyard. The seep studies currently under way will tell us more about how oil production affects the air, water, and beaches in Santa Barbara, as well as all the creatures who live in this diverse environment.

With greater knowledge comes a greater understanding and ability to make decisions that improve our future and our children's future.



This infrared high altitude photograph shows the huge oil slick created by the La Goleta seeps over the South Ellwood Offshore Field. This natural oil slick forms the tar that's found on local beaches and half of the tar on Los Angeles County beaches. When this photograph was taken, an onshore breeze was pushing the slick toward the beaches near the University of California, Santa Barbara.

A.D.1997

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On this Page:
Present day photo of the Santa Barbara Channel ocean surface shows oil and gas bubbles eminating from a natural seep.

Illustrations/Photos

Russell A. Ruiz	Illustration on Cover Illustrations on Pages 1, 3, 5
Jan Stensland	Illustrations on Pages 2, 3, 4, 6, 9
Spencer Weiner	Photo on Page 8 and This Page (seeps on ocean surface)

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Hydrocarbons in the marine environment: relationships between natural hydrocarbon seepage and oil production

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Good afternoon ladies and gentlemen. My name is Libe Washburn and I am an associate professor in the Geography Department at UC Santa Barbara. My field of study is physical oceanography with an emphasis on interdisciplinary research issues. Thank you for giving me the opportunity to discuss some of the oceanographic research that my colleagues and I are conducting at UCSB. For the past year I have been involved in a multidisciplinary study of natural hydrocarbon seepage in the Santa Barbara Channel that is being conducted by the Institute for Crustal Studies at UCSB. The overall study involves the participation of six faculty members and six graduate and post-graduate researchers at UCSB. Participants in the study come from four university departments and cover the fields of oceanography, geophysics, remote sensing, biology, and chemical engineering. Participants in the study also come from industry. One participant is a geologist from Mobil Oil Corporation who is a visiting research scientist at UCSB. We are also working with private companies that have expertise in specialized techniques for detecting hydrocarbons in seawater and who have important baseline data for detecting changes in the marine environment.

We think this work is an example of the innovative research that can be pursued by the academic community in cooperation with the private sector. The initial results of our study are unexpected and we think you will find them interesting. However, you should bear in mind that this is on-going research and we are actively involved in field

studies, data analysis, synthesis of historical records, and careful searches for existing scientific literature. Our work has been funded through the peer-review process and results from our research will be published in the peer-reviewed literature.

The preliminary findings of this work indicate that there has been a reduction in natural hydrocarbon seepage over the past twenty years near an offshore oil platform in the Santa Barbara Channel. This reduction has occurred during a time of oil production at the platform and we hypothesize that this production has lowered natural seepage rates. We are working to verify this hypothesis and to accurately quantify changes that have occurred. We are also working to understand the implications of our findings. To the best of our knowledge, this is the most detailed study to ever examine a change in seepage over time in the marine environment.

I will continue my presentation by showing you some of the evidence that a reduction in hydrocarbon seepage has occurred. I will end by elaborating on the possible consequences and significance of this finding.

The Santa Barbara Channel is an area of intense natural hydrocarbon seepage (Wilson et al., 1974 and Allen et al., 1970). As far as we are aware, the only area of greater natural marine seepage in the world is in the Caspian Sea in the former Soviet Union. The abundant tar found on southern California beaches is due to this natural seepage. All of the tar on Santa Barbara's beaches and half of the tar on Los Angeles beaches comes from the natural seeps offshore from Coal Oil Point (Hartmond and Hammond, 1981), near the UCSB campus. The volatile hydrocarbons from these seeps are also a significant source of air pollution in Santa Barbara and Ventura Counties (Killus and Moore, 1991). The smell of hydrocarbon compounds from the natural seeps is often present on the UCSB campus.

Our research group has been studying these seeps in order to quantify the total amount of hydrocarbon emissions and to determine if there has been any change in emissions due to offshore oil production. Each oil field in the Santa Barbara Channel has some associated natural hydrocarbon seepage. This **figure (#1)** shows the oil fields in the Santa Barbara Channel. We have focused our initial efforts on the seeps above the South Ellwood Offshore Field, because the seeps are extremely intense at this location. There is also an offshore platform that has been producing oil from a portion of the natural seep field since 1967. The seepage is coming from oil in the Monterey Formation, which has been produced from Platform Holly since 1972.

This **figure (#2)** shows a map of the seep activity on the South Ellwood Field in 1994 that was measured with a sonar survey. The total gas seepage from this field is about 5 billion cubic feet per day. In addition, about 6 thousand gallons of oil is naturally seeping into the ocean every day. About 8% of the gas seepage is being captured by seep containment devices ("seep tents") that were placed on the seafloor one mile east of Platform Holly in 1982. The surprising result of this survey is how little seepage was occurring within one mile of Platform Holly in 1994 and 1995. The area around Platform

Holly had been thoroughly documented as an area of intense seepage by oil industry surveys in the 1940's, 1950's, and 1970's (Fischer and Stevenson, 1973). Based on this finding, a research grant was obtained from the University of California's Energy Study Program to acquire new high-resolution seismic data in 1995 to compare with data obtained in 1973. The next overhead shows a comparison of data acquired between Platform Holly and the seep tents in 1973 and 1995.

The top of this **figure (#3)** shows the intense seepage around Platform Holly that was recorded by an acoustic survey in 1973. The figure shows dark areas in the water column that correspond to rising plumes of bubbles. The bubbles themselves are composed mostly of methane, but also contain ethane, propane, and other constituents. The bottom of the figure shows the seep activity in 1995 along the same line. Note the dramatic reduction in seepage that has occurred over this section which covers a horizontal distance of about one mile. Quantitative analysis of this data indicates about a 90% reduction in seepage within one mile of Platform Holly over the past 22 years. The area around Platform Holly is the only area that has experienced a reduction in seepage, based on our geophysical surveys. The reduction in seepage around Holly may result from a reduction in reservoir pressure due to withdrawal of oil.

Another line of evidence indicating a decreasing seepage rate around Platform Holly comes from oceanographic surveys which measure dissolved hydrocarbon concentrations in the ocean downcurrent from the seep field. The dissolved concentration can be used as a measure of seep activity, because seep gases partially dissolve in the ocean as they rise from the seafloor (Fischer, 1978). Dissolved hydrocarbon components are carried downcurrent, where they have been measured in past surveys. In 1995 we measured dissolved hydrocarbon concentrations in an area that was surveyed in 1981 by InterOcean Systems, Inc. of San Diego California. We have been working with InterOcean in the synthesis of these data sets. This **figure (#4)** compares propane concentrations between 1981 and 1995. The peak concentrations measured in 1981 were nearly ten times as high as in 1995. Although ocean currents also influence hydrocarbon concentrations, this is a larger reduction than can probably be accounted for by currents alone. However, we are collecting oceanographic measurements and are using computer models to understand the effects of currents on the concentrations. Some of the data that we are using in our analysis has been generously supplied by the Coastal Oceanography Group at the Scripps Institution of Oceanography. Our observation of a change in dissolved hydrocarbon concentrations is consistent with a decrease in seep activity since 1981.

If the hypothesis that oil production has reduced natural hydrocarbon seepage is true, then some local and national implications need to be explored. At the local level, reduced seepage will lower the total amount of reactive organic gases released into the atmosphere offshore from Santa Barbara. It will also lower the amount of tar and oil in local waters. Reactive organic gases are precursors to smog-forming ozone which is a health hazard. Tar and oil wash up on our beaches and diminish their recreational and aesthetic values.

Results from our research may have national significance as well. They suggest that reductions in natural seepage due to oil production must be accounted for when determining greenhouse gas emission inventories. Methane is a greenhouse gas that is 20 to 30 times as potent as carbon dioxide. Around Platform Holly methane emission due to natural seepage has decreased by about 15 to 25 tons per day. This decrease is equivalent to 12-20% of the global warming potential produced by burning the oil that comes from this field each day. The reduction in natural seepage may persist after oil production has stopped and a key research issue is understanding the long term relationship between oil production and natural seepage.

We emphasize that our study is focused on a small region around a single platform. It is not known if the changes in seepage rates at the South Ellwood Field are typical of other oil fields around the world. To the best of our knowledge, there is no research directed at understanding changes in natural hydrocarbon seepage around oil fields, either in the United States or overseas, except at Platform Holly. We feel that interdisciplinary studies spanning the areas of oceanography, geophysics, geology, biology, and climatology are necessary to understand the global significance of this issue.

In summary, we feel that our project is a good example of a cooperative research effort being conducted by members of the scientific community and industry. It also illustrates how basic scientific research can produce in practical results with policy implications. Thank you for your attention.

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Acoustic Image of Seep Activity

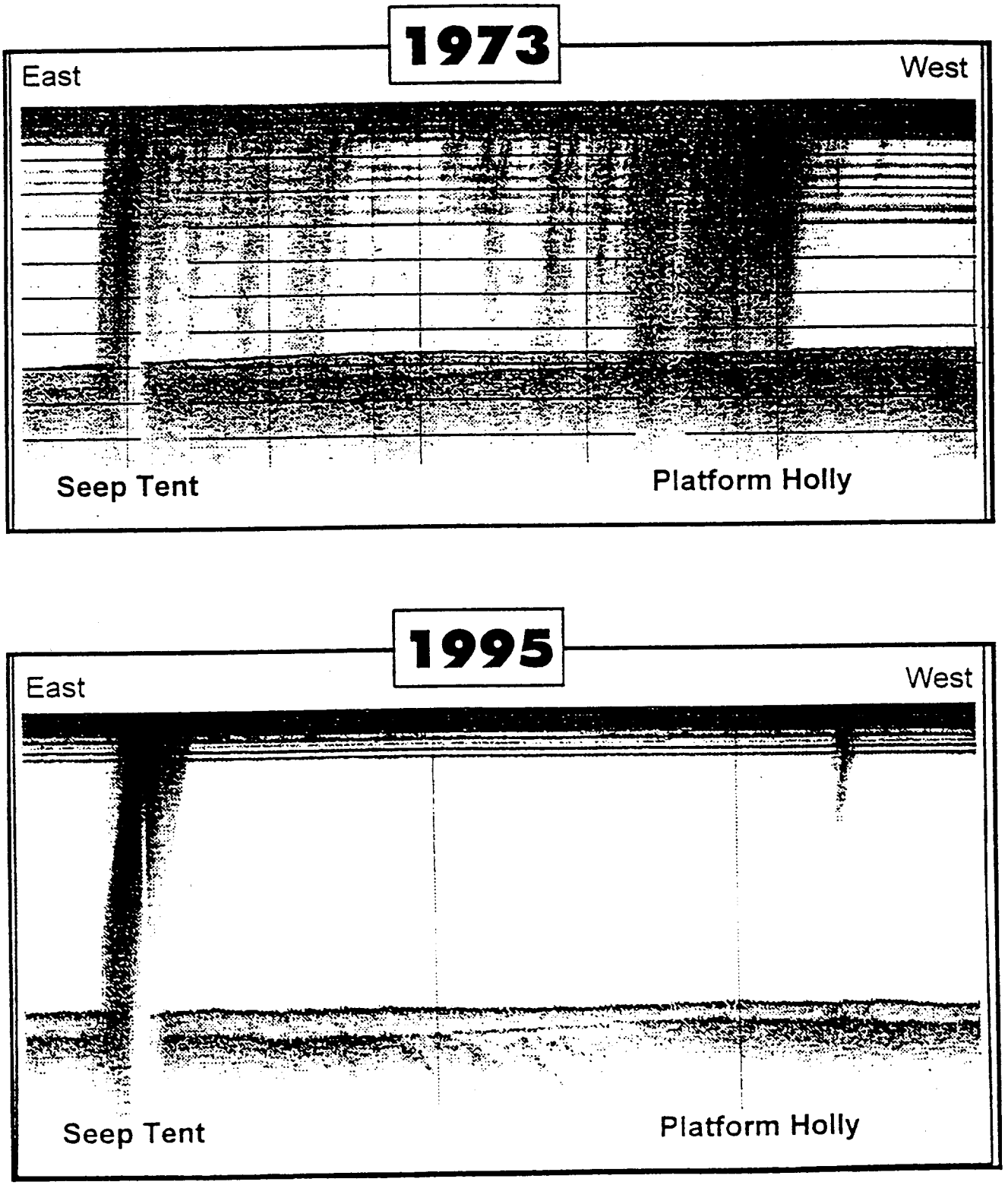

Figure 3. Seep activity in 1973 compared with 1995. Dark columns show rising bubble plumes of seep gases. Distance between Platform Holly and Seep Tents is approximately 1 mile.

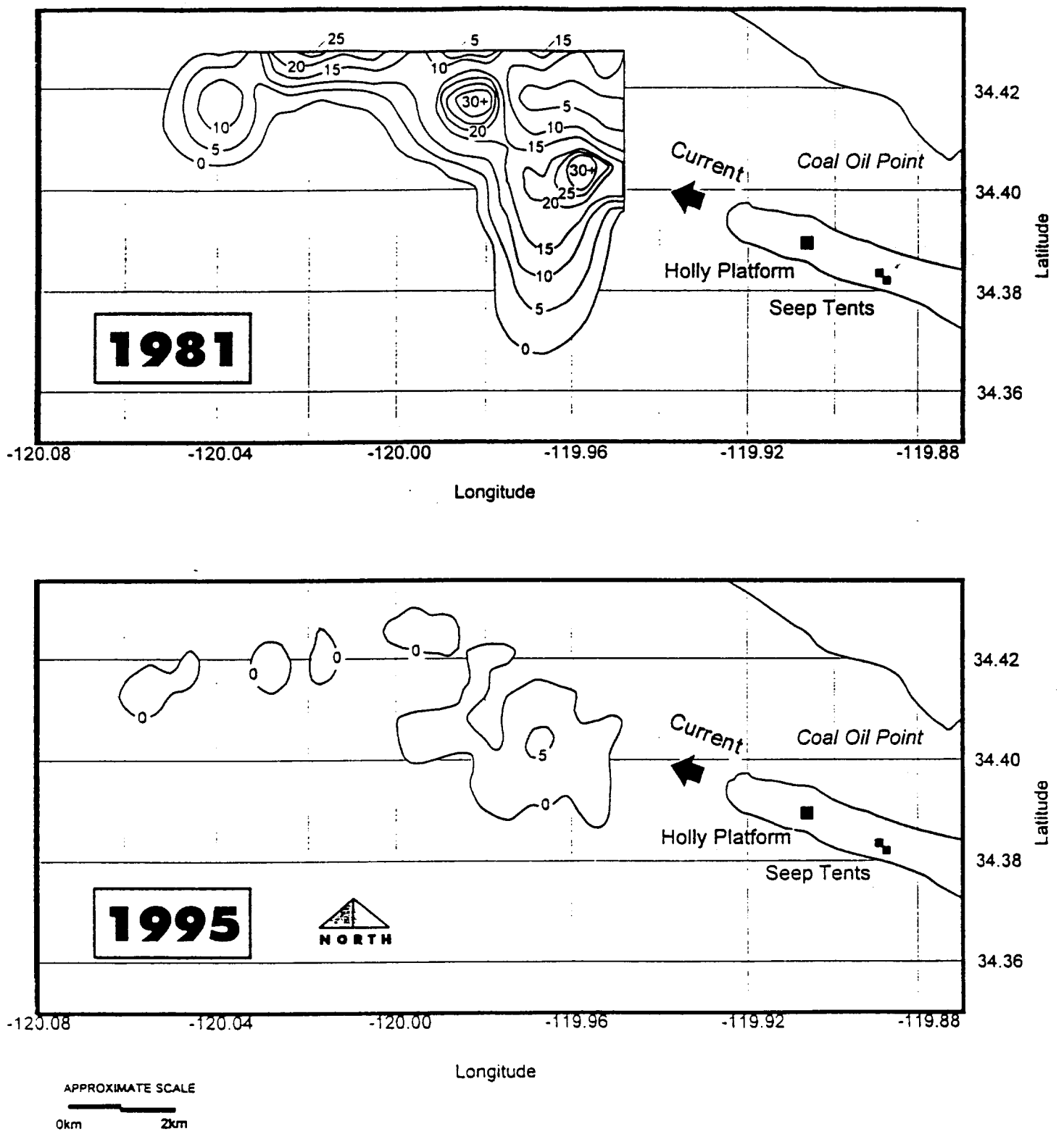

Figure 4. Oceanic concentrations of dissolved propane over the South Ellwood field in 1981 compared with 1995. Contour levels are shown in parts per million.

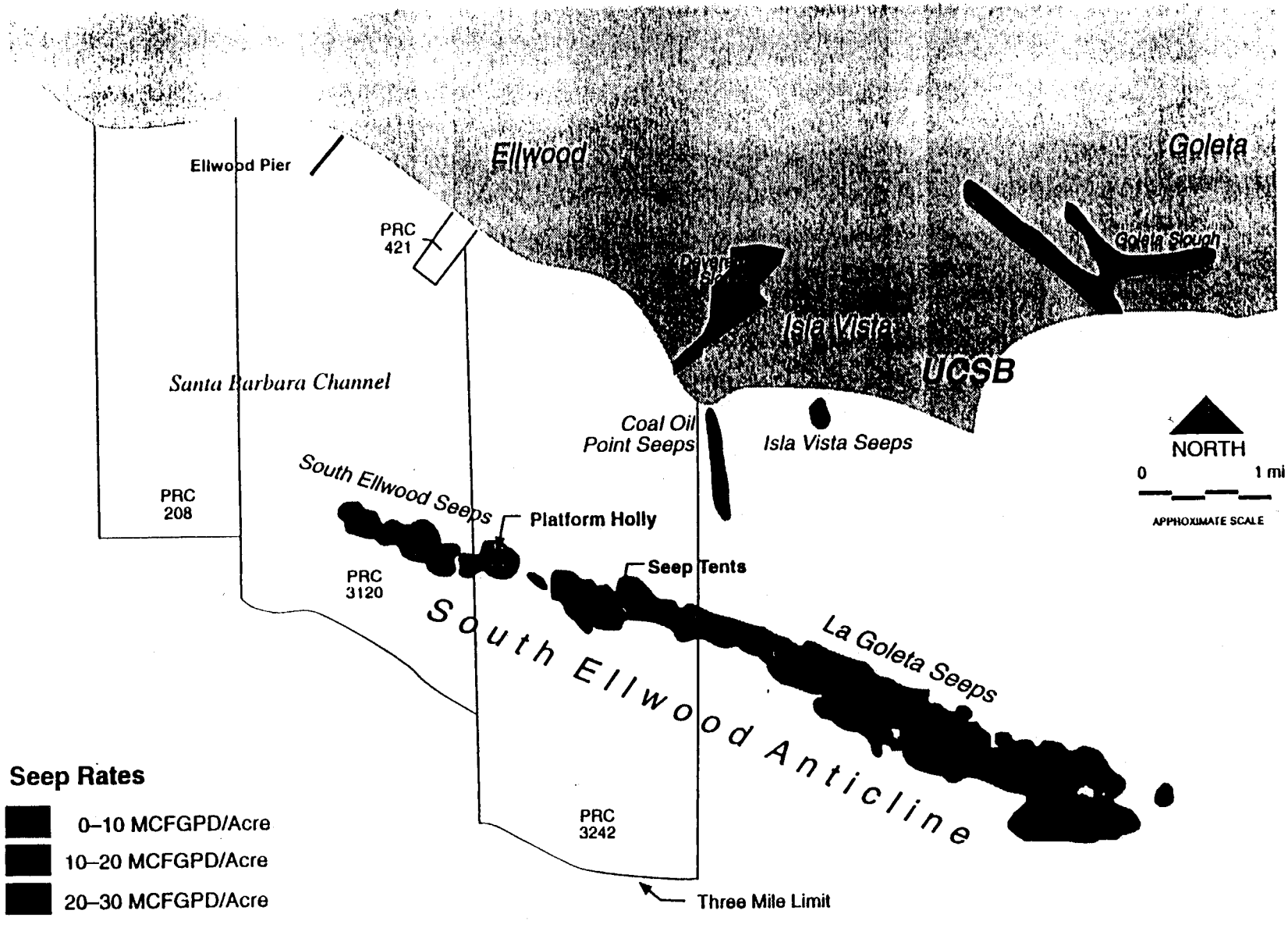

Figure 2. Hydrocarbon seepage rates on the South Ellwood offshore oil field. Data obtained in 1994 by the Institute for Crustal Studies, UCSB. Units are millions of cubic feet of gas per day per acre (MCFGPD).

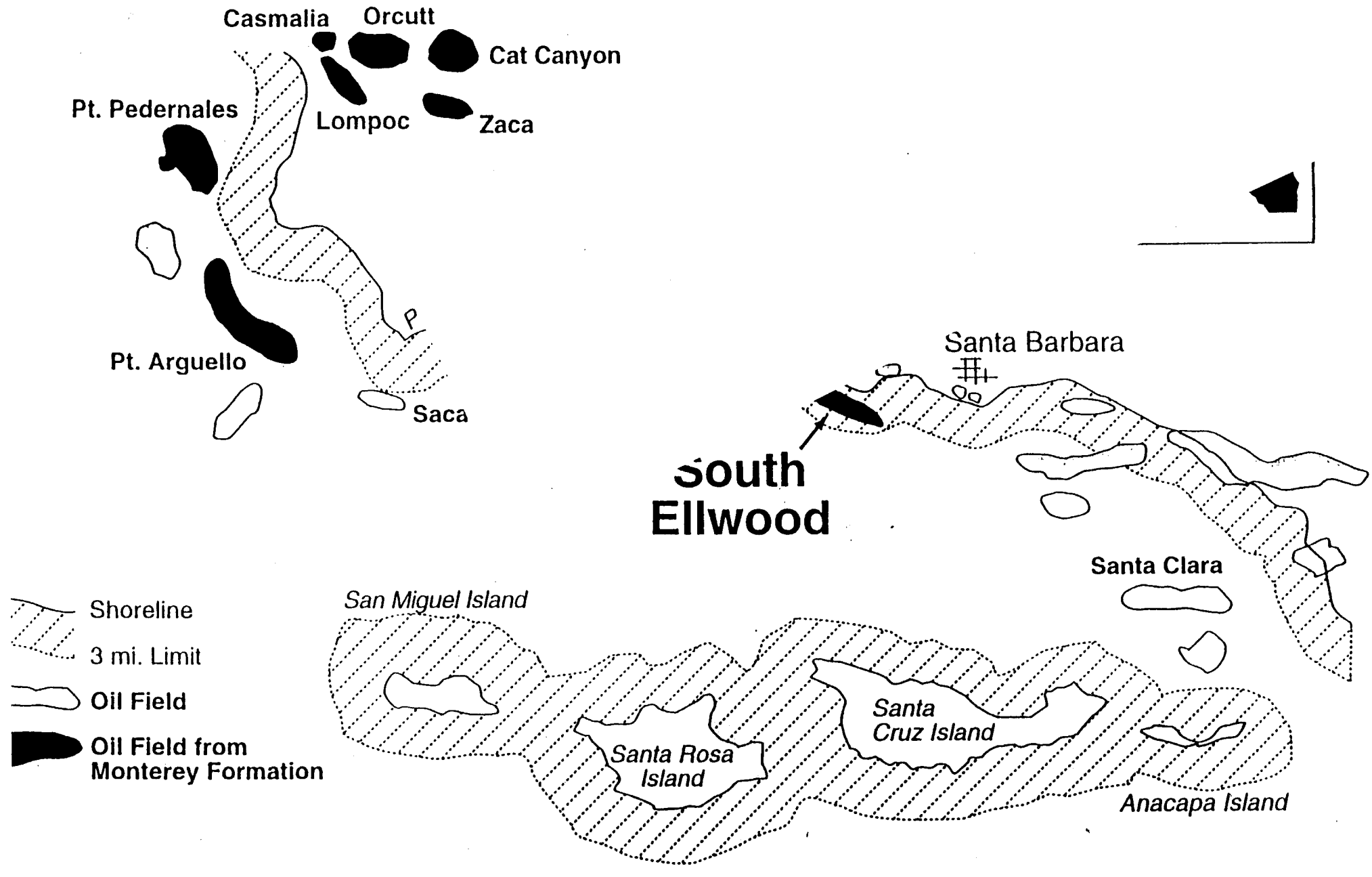

Figure 1. Oil fields in and around the Santa Barbara Channel.